For some reason, people are willing to volunteer to that computer terminal things they aren't willing to tell their own physician. It's an interesting phenomenon, the rapport that patients develop with the computer.

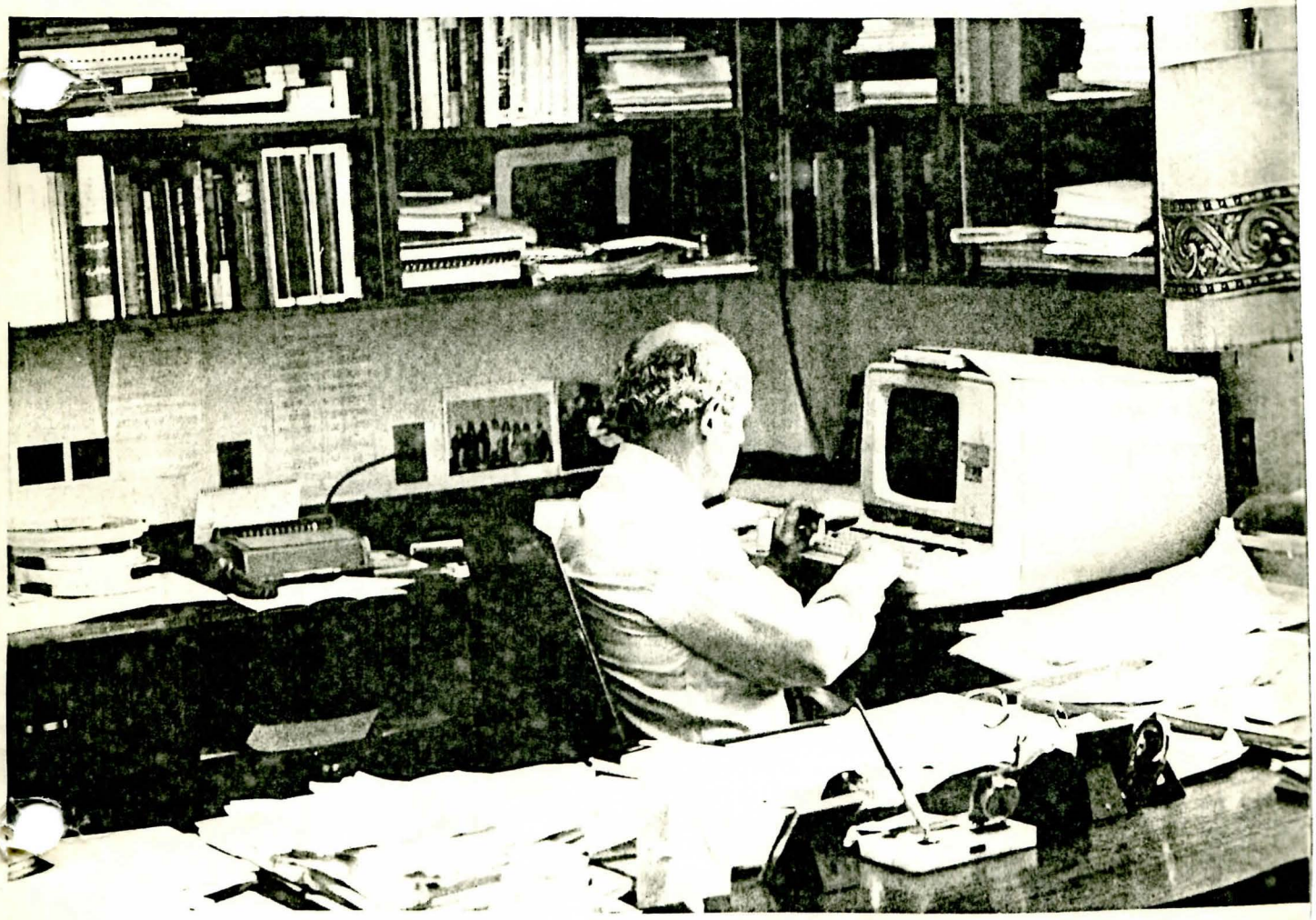
ON CONFIDING IN COMPUTERS

the work and world of Homer Warner

A MALE PATIENT walks into the admitting area of Latter Day Saints Hospital in Salt Lake City for minor elective surgery. Before he is admitted to his room, he is asked to sit in front of a video terminal and answer a battery of questions about his family medical history and the current state of his health.

The process takes about 15 minutes.

A large computer on the seventh floor of the hospital digests the information and quickly regurgitates a printout for the attending physician. In this case, the

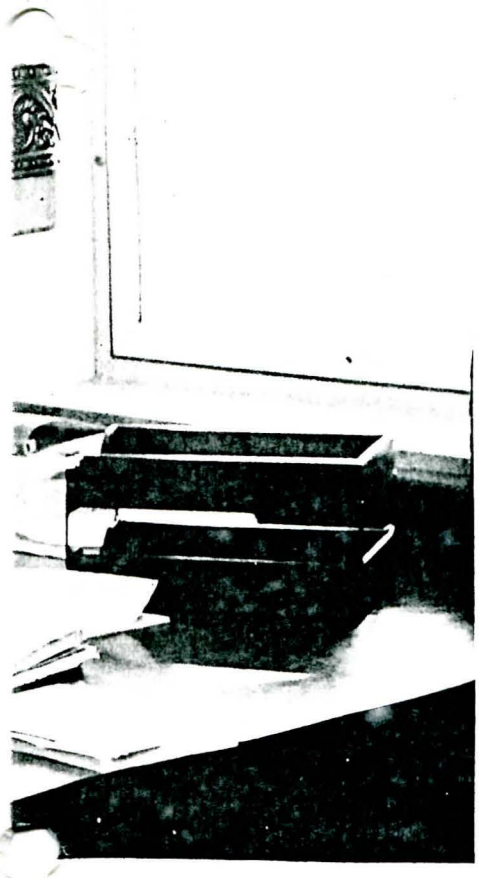


Homer Warner at work.

printout alerts the physician to the fact that the entering patient has all the symptoms of acute gonorrhea. The doctor confirms the gonorrhea, cancels the elective surgery, and begins treatment.

The system is the product of Mayo alumnus Homer R. Warner, one of the world's leading experts on computer medicine.

Doctor Warner set up one of the first applications of computers to clinical medicine at Latter Day Saints Hospital 20 years ago. Today, he is chairman of the Department of Biophysics and Bioengineering at the University of Utah. His main interest continues to center on how computers can help organized medicine bring more quality care to greater numbers of people. The University of Utah and its affiliated Latter Day Saints Hospital, where Doctor Warner has his office, are generally recognized as two of the leading institutions riding the crest of this new wave in medicine.



Homer Warner's interest in research took root while he was a fellow at Mayo in the early '50's. The man responsible was Earl Wood.

"When I first met Earl Wood I was in the second year of my residency and I had become a little bit bored by it all ... I thought I knew everything and had conquered it all ... but then I dropped by a noon lecture that Earl Wood was giving on dye curves in the diagnosis of congenital heart disease, and suddenly this whole new area just seemed to open up for me. That lecture changed my whole life.

"Earl's the kind of man you can learn more from by watching him than listening to him. It's hard to explain ... it's just the way he operates. The kind of enthusiasm he stirs up in everyone who works for him is so contagious.

"There's nothing subtle about Earl at all. He's so forthright. It's all right on the surface ... and everybody respects and loves him for it."

With the germ of life-long fascination with computers planted at Mayo, Homer Warner returned to his native Utah. He began pursuing a variety of applications for "this very powerful new device."

Up until the early 1960s, most of the applications involved analog computers carrying out tedious calculations normally performed by physicians or technicians. Then, 12 years ago, the University of Utah received its first digital computer. Homer Warner saw a whole new world open up.

He began to work on applying statistical analysis to the diagnostic method in detecting congenital heart disease.

"We wrote one of the first papers on this subject from that project," Doctor Warner explains. "We were very much encouraged because, using the same data, the machine could do as well as the best physician and a lot better than those who were not experienced in congenital heart disease.

"Although we've come a long way since then, that study has to be credited as really providing the initial stimulus for us in this entire area."

That "initial stimulus" has grown into a large area of computers in a room adjacent to Doctor Warner's office; a terminal is as much a part of his neat and orderly office as a prescription pad is for another physician.

Today, the computer system pioneered by Warner is involved in pre-admission screening, including electrocardiogram analysis, pulmonary function tests, patient history, and patient demographic data; heart catheterization; patient monitoring in intensive care and coronary care units and hospital operating rooms; and clinical laboratory work.

Perhaps the most intriguing use involves patient screening. Homer Warner sees the potential of pre-admission screening going well beyond the bounds of hospitals, into sparsely populated

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towns and rural areas that feel the crunch of the physician maldistribution problem.

"Our goal is to try to find a means by which we can bring expertise from all medical specialty areas in terms of decision-making to bear on any patient's problem in any doctor's office," Doctor Warner says. "If we can store the logical process that a specialist uses in a form that the machine can use, then that same logic can help a computer make a decision that an expert would have made, given the same set of data. This will be a major step in providing better health care."

The implications of such a system for quality control are staggering. Doctor Warner again:

"I think it's generally conceded that you can get medical care in the United States as good as you can find anywhere in the world. The criticism of American medicine comes in the distribution problem . . . some people can get the quality care, but can everybody?

"In any 'industry' where there's an uneven distribution of quality, you've got to build in a control factor that in some way lets you measure that quality in an ongoing way. The PSRO is explicitly directed toward introducing this concept into medicine.

"I see no way that we're going to effectively do the peer review job without in some way mechanizing this so that the human part of the review can be directed toward those particular cases that represent exceptions which will be determined by the computer.

"Once a physician or a set of physicians can specify criteria for a given decision that can be put into a computer-readable form, then you can pass any number of cases through that logic and see which ones of them satisfied it and which ones didn't. The computer can screen out the cases that failed to live up to the model and those cases can be reviewed manually."

Right now such a computer application is being used at Latter Day Saints Hospital only for a preadmission screening. Still, as in the case of the man who would admit his gonorrhea symptoms only to the computer, staff physicians are often alerted to additional disease symptoms or important preoperative medical information concerning a patient.

According to Doctor Warner's data, his computers can be even more effective in picking up patient abnormalities than are staff doctors. The computers have successfully identified about twice as much cardiovascular disease by running an electrocardiogram on every entering patient as opposed to waiting for physicians to order an electrocardiogram as the result

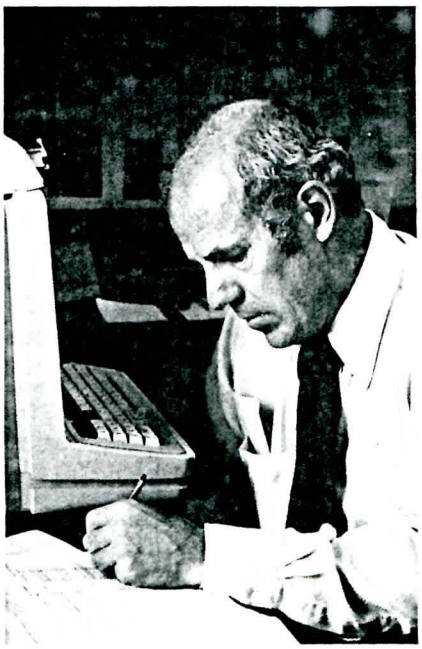
of patient symptoms.

With these results in mind, Doctor Warner carefully enters the perilous waters of periodic screening of all "well" people. He believes that, as more people demand a greater effort in preventive medicine, computer screening will be the front end to the medical system.

More intriguing still to Doctor Warner is the potential for linking up family medical histories into a computer bank to determine an individual's potential for encountering certain diseases during his or her life. Last summer the University of Utah began a project which will cross reference the four-generation geneology of the Mormon Church with the university's 45,000-patient cancer file. The results could give some clues as to whether certain types of individuals or families may be more predisposed to contracting cancer than others and whether all individuals can have some probabilities determined early in life of their potential for encountering cancer or other serious life-threatening diseases.

For all the futuristic technological planning taking place in the Warner laboratory, much of his work is still centered on what today is considered routine applications. One is the monitoring of patients in intensive care units. Doctor Warner's computers have

Doctor Warner



resulted in Salt Lake City having perhaps the largest single concentration of computerized ICU and CCU beds in the world.

An interesting aspect of the well-accepted computerized patient monitoring is a new decision-making criteria program that will not only alert a nurse about trends in an intensive care patient but will make explicit suggestions about treatment of the patient based on pre-stored logic.

If the computer is becoming well-accepted in the intensive care unit, it has become almost mundanely routine to people in

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the clinical laboratory. "In the clinical laboratory it isn't a matter of whether or not you're going to have a computer, it's a matter of which one," Doctor Warner says. "We've reached the day where the computer has become an essential piece of equipment in the laboratory."

For large medical centers such as Latter Day Saints Hospital, purchasing computers and hiring the personnel to maintain them is no major problem; for the average hospital it is. The solution appears to be a growing industry of private companies which will not only provide the hardware and programs but also the personnel to operate and maintain the equipment.

Homer Warner and Earl Wood both sit on the advisory board of such a company — Salt Lake City's Medlab Computer Services. ('Medlab' is a name first coined by Doctor Warner in the '50s to identify the computerized systems on which he was working.) In the late 1960s, he encouraged the formation of a private corporation which would offer computer services to individual hospitals. He also encouraged his colleagues to become involved in the company as a moonlighting venture. ("It was either that or lose many of them to another private corporation. I thought if we couldn't beat 'em, we better join 'em.")

The result is a corporation that offers hospitals a turnkey operation, including hardware, software, and all maintenance. Medlab provides the hospitals with a small independent computer, training for hospital personnel, updated program revisions, and one fulltime individual on site to provide maintenance and systems guidance. The hospital provides physical space and technicians to operate the equipment.

Doctor Warner explains that the computer hardware is the simplest part of the entire system for a hospital to obtain, with costs dropping dramatically for small computers. The software continues to be a major obstacle.

"No systems are any better than the people who work with them," he maintains. "A company like Medlab is really selling a service rather than equipment. You need one or two people who really understand what's happening inside that black box, but you need people who can learn some very simple procedures on the front end.

"Downstream in time it may be that all hospitals will have skilled computer people on their own staffs. Right now they don't. You can't just dump a piece of hardware into a hospital facility and expect it to work."

While Latter Day Saints Hospital has made innovative uses of computer technology in clinical and laboratory medicine, it also has put the machines to use creatively in medical education. Doctor Warner and his colleagues have stored 7,500 different cases in the computer, which acts as a simulator of disease for medical students who practice making decisions

based on the symptoms presented to them. Similar approaches are used in continuing education projects for house staff and paramedics. But for all of their proven value, Doctor Warner still encounters resistance on the use of computers in medicine. Much of the resistance he considers healthy skepticism: some knee-jerk naysaying.

"Some of the resistance we encounter is justified, such as during the early debugging stages of a particular program when we are having problems with it. Here the resistance is very natural and usually constructive.

"But, there are a certain number of doctors who have their backs up about a computer and they 'know' it's no good before they even try it. On the other extreme, we have those who are very enthused before they ever know what it is. But the bulk of people are in the middle. They want to try it and see what it'll do for them, and they have a healthy skepticism about it."

Some computer skeptics are technicians who feel threatened because the machine has taken over tasks which they previously performed. Doctor Warner sees no need for the insecurity.

"The machine raises the level of the technician from doing the mundane, repetitive task to essentially overseeing that and allowing the person to work at a much higher conceptual level. The machine can't do things like conceive ideas, which is the ultimate level of work for human beings. The machine frees up people to work at this level."

Doctor Warner, an intense, controlled man who is an official in the Mormon Church, sidestepped the issue of when and if machines should be allowed to sustain life and when and if they shouldn't.

"I don't get involved in those types of decisions. I'm not practicing medicine. The only person who gets involved in those types of decisions is the person who's responsible for that patient."

While Doctor Warner refuses to make flat judgments on the ethical and moral questions of machinery sustaining human life, he is willing to admit that physicians must make hard decisions on the most effective use of medical technology.

"Those decisions must be made every day — whether it's the artificial kidney or equipment in the intensive care unit. You've essentially got a limited resource which has to be optimally allocated. Someone has got to make those decisions. It's never an easy decision."

But the work of Doctor Warner and his colleagues is multiplying such decisions for health care providers. With the opportunities of futuristic technological advances comes the price that must be paid — a heavy responsibility for their most effective and judicious use.

And, according to Doctor Warner, "that responsibility the researcher must turn over to the practicing physician."

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